

## University of Groningen

### The obesity epidemic in Europe

Vidra, Nikoletta

**IMPORTANT NOTE:** You are advised to consult the publisher's version (publisher's PDF) if you wish to cite from it. Please check the document version below.

*Document Version*

Publisher's PDF, also known as Version of record

*Publication date:*

2019

[Link to publication in University of Groningen/UMCG research database](#)

*Citation for published version (APA):*

Vidra, N. (2019). *The obesity epidemic in Europe: Assessing the past and current mortality burden and the future of obesity*. [Thesis fully internal (DIV), University of Groningen]. University of Groningen.

**Copyright**

Other than for strictly personal use, it is not permitted to download or to forward/distribute the text or part of it without the consent of the author(s) and/or copyright holder(s), unless the work is under an open content license (like Creative Commons).

The publication may also be distributed here under the terms of Article 25fa of the Dutch Copyright Act, indicated by the "Taverne" license. More information can be found on the University of Groningen website: <https://www.rug.nl/library/open-access/self-archiving-pure/taverne-amendment>.

**Take-down policy**

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

Downloaded from the University of Groningen/UMCG research database (Pure): <http://www.rug.nl/research/portal>. For technical reasons the number of authors shown on this cover page is limited to 10 maximum.

## English Summary

### **The obesity epidemic in Europe: Assessing the past and current mortality burden and the future of obesity.**

Obesity is considered one of the biggest public health challenges of the 21st century, not only because of its epidemic nature, but also because of its serious health effects. As obesity is associated with a higher risk of developing a range of diseases, and, ultimately, of mortality, it represents a considerable threat to the health of populations. This threat is especially relevant in Europe, which has been hit hard by the obesity epidemic. Europe is currently the region with the second-highest obesity prevalence levels worldwide after the US. Given that large numbers of Europeans are suffering from obesity, gaining a deeper understanding of the future progression of obesity in Europe, and of its associated mortality burden, is essential.

Despite the importance of research on obesity, detailed knowledge of the mortality burden of obesity in Europe, and of how it is changing over time, is limited. Most previous research on the mortality burden of obesity focused on the USA, or on a single European country. Moreover, most of these studies focused on the mortality burden at a single point in time. As a result, we lack a comparative framework of the mortality burden of obesity in Europe, and of the time trends in the development of this burden.

The main objective of this thesis was to provide new and detailed insights into how obesity affects mortality levels and trends at the population level in Europe, and how the obesity epidemic in Europe is likely to develop in the future.

In this thesis, a multidisciplinary approach was applied that combined knowledge, methods, and data from both demography and epidemiology. For the analysis, recent demographic and epidemiological data were used, and advanced demographic and statistical modelling techniques were applied. By applying both a cross-country approach and a temporal approach (by focusing on past and future trends), detailed comparable information with considerable public health relevance was obtained.

**Chapter 1** presented background information, and framed the problem and the research questions. It also described the recent state of the art in the following areas of obesity research: the mortality burden associated with obesity, especially in terms of obesity-attributable mortality; the impact of obesity on all-cause mortality/life expectancy; and the future burden of obesity.

**Chapter 2** attempted to determine which methods for estimating obesity-attributable mortality can be applied in a European setting when taking a temporal approach. More specifically, the impact of these methods on the levels and trends in obesity-attributable mortality was evaluated for the

Netherlands over the 1981-2013 period. Three all-cause approaches (a partially adjusted approach, a weighted sum approach, and the two approaches combined) and one cause-of-death approach (comparative risk assessment (CRA), which we adjusted to purely capture obesity) were applied. The results showed that the application of these different approaches led to different estimates of obesity-attributable mortality fractions (OAMFs) in the Netherlands, ranging from 0.9% to 1.5% in 2013. All of the approaches revealed that there was an increase in OAMFs over the study period, with the exception of the adjusted CRA approach, which showed a decrease among women. Thus, estimates of obesity-attributable mortality levels and trends differed depending on the method applied.

**Chapter 3** evaluated the contribution of age, period, and birth cohort effects and patterns in obesity-attributable mortality in eight European countries: namely, the Czech Republic, Finland, France, Germany, Hungary, Italy, Poland, and the UK. Obesity prevalence and all-cause mortality data by age (20-79), sex, and country for the 1990-2012 period were used in the analysis. The results indicated that the nonlinear birth cohort contributed significantly to obesity-attributable mortality trends ( $p < 0.01$ ) in all of the populations studied, except among men and women in the Czech Republic and Finland, and among German women and Polish men. The largest contributions, which exceeded 25%, were observed among men and women in the UK and among women in France. Increases in mortality rate ratios (MRRs) for each successive cohort born after 1950 were found only among men and women in the UK. For the rest of the populations with significant cohort effects – namely, German men; Polish women; and French, Hungarian, and Italian men and women – the analysis showed that the MRRs increased in the cohorts born in 1935-1960, but decreased in the cohorts born thereafter. To conclude, the birth cohort dimension is important for describing and explaining trends in obesity-attributable mortality.

**Chapter 4** aimed to assess the impact of obesity on life expectancy levels and trends over the 1975-2012 period for the United States and for 26 European national populations: namely, Austria, Belarus, Belgium, the Czech Republic, Denmark, Estonia, Finland, France, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, the Netherlands, Norway, Poland, Portugal, the Russian Federation, Slovakia, Spain, Sweden, Switzerland, Ukraine, and the United Kingdom. This was done by measuring the potential gain in life expectancy (PGLE) if obesity-attributable mortality had not occurred. The results show that in the 26 European countries in 2012, the PGLE ranged from 0.86 to 1.67 years among men and from 0.66 to 1.54 years among women, and was estimated to be 1.74 years among men and 1.44 years among women in the US. The PGLE showed an increase in all of these countries over the study period, and was stronger among men than among women. However, the findings also indicated that the PGLE levelled off after 1995 among women in Denmark, Switzerland, and the Central and Eastern European (CEE) countries. When we estimated the increase in life expectancy at birth between 1975

and 2012 without obesity, we found that the increase would have been, on average, 0.78 years higher among men and 0.30 years higher among women. Thus, obesity has affected both life expectancy levels and life expectancy trends in Europe, albeit to varying degrees across countries and between women and men.

**Chapter 5** aimed to forecast obesity over the long term using a novel approach that took into account the underlying epidemic wave pattern implemented in the Lee-Carter forecasting technique. The countries included in the forecast were Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, the United Kingdom, and the United States. Obesity prevalence data for 1975-2016 were used. The analysis of past trends showed that obesity increased in all of the countries between 1975-2016, but that the increase in obesity prevalence declined over the 1990-2016 period. Obesity was projected to reach maximum levels between 2026 and 2054, and these maximum levels were estimated to be highest in the US (44%) and the UK (37%) and lowest in the Netherlands (28% among men) and Denmark (24% among women). It was further projected that the highest maximum levels will be reached first in the US and the UK. Thus, the findings suggest that the obesity epidemic in Europe will reach its peak between 2026 and 2054 at levels of at least 25%.

Finally, in **Chapter 6**, the main results are summarized and discussed in detail. In addition, reflections on the methodological approach and the implications of the findings for public health policies are presented.

Overall, this PhD thesis revealed that the mortality burden of obesity in Europe is significant, albeit with clear variations between countries. Specifically, the obesity-attributable mortality fraction (OAMF) in the 26 European countries in 2012 was estimated at, on average, 11% among men and 10% among women. The impact of obesity on life expectancy in Europe in 2012, as measured by the potential gains in life expectancy (PGLE) if obesity was eliminated, was estimated at, on average, 1.22 years among men and 0.98 years among women. The mortality burden of obesity was found to be slightly lower, on average, in Western than in Eastern Europe. Within Western Europe, the UK exhibited the largest mortality burden. The mortality burden of obesity (OAMF, PGLE) was shown to increase over time, with essential birth cohort effects. According to our forecast, the obesity epidemic in Europe will reach its peak between 2026 and 2054 at levels of at least 25%.

The considerable mortality burden of obesity found for Europe is in line with the high obesity prevalence levels observed across Europe. Similarly, the finding that the mortality burden of obesity has increased over time is in line with the observation that obesity prevalence has increased sharply in Europe in recent decades. A comparison of the current PGLE estimates of obesity with those of

smoking and alcohol showed that the impact of obesity on life expectancy levels lies between that of smoking and alcohol. It is, therefore, clear that the mortality burden of obesity in Europe should not be ignored.

The variations in the mortality burden observed across European countries can be related to the different stages of the obesity epidemic these countries have reached. Specifically, the progression of the obesity epidemic has clearly differed in Western and in Eastern Europe, mainly because the economic and political changes that occurred in Eastern Europe only led to the stagnation of obesity in those countries. The remaining variations observed across countries have been attributed to a wide range of contextual and individual factors, such as differences in economic and political conditions, in obesogenic environments, and in dietary and physical activity patterns that are partly related to socioeconomic status.

Our findings clearly show that of the Western European countries studied, the UK is the forerunner in the obesity epidemic, and thus closely follows the trends observed in the US.

This thesis encompassed some novelties and went beyond previous research. Specifically, our use of a comparative framework in combination with a temporal approach provided us with detailed insights into the mortality burden of obesity and its development over time. For the first time in a study conducted in Europe that focuses on obesity-attributable mortality, the birth cohort dimension was included. In addition, we applied a novel projecting approach that enabled us to generate long-term forecasts. At the same time, this PhD research was subject to limitations, including limitations in the majority of the data used; namely, the obesity prevalence data, the relative risk data, and the cause-specific mortality data. Future research would greatly benefit from studies that address this knowledge gap, as the data produced by such studies could improve the estimates of obesity-attributable mortality.

The results of this thesis have important implications, as they indicate that obesity and its associated mortality burden should be given more attention in both societal and public health policy discussions. In particular, public health policies that are effective in preventing obesity from increasing further are needed. The large variations in obesity and its associated mortality burden that have been found across European countries suggest that strategies tailored to different countries, combined with multi-level interventions, are required to address the multifactorial aetiology of obesity. Our finding that birth cohort effects play a large role in obesity trends suggest that interventions starting early in life could contribute to the development and maintenance of healthy habits. These policies are essential not only for tackling the obesity epidemic, but for improving the overall health and well-being of populations across Europe, today and in the future.